UCRL-JC-124874 Abs

Towards predicting the threshold of the large area: threshold mapping

Jean Hue
LETI-CEA-DOPT- Couches Minces pour l'Optique (CMO)
CENG,17, avenue des martyrs 38054 GRENOBLE Cedex 09 FRANCE
Phone : (33)-76-88-99-31 Fax : (33)-76-88-50-46

Francois Génin, , Steven Maricle, Mark Kozlowski
University of California
Lawrence Livermore National Laboratory
P. O. Box 808, L-496
Livermore, CA 94550

ABSTRACT:

As the size and quality of optics has increased, so has the difficulty in effectively measuring/defining their laser damage threshold. This is exemplified in the case of the optical coatings being developed for the NIF laser in the US and the LMJ laser in France. For these optics the damage is a localized phenomenon so adequate statistical data is needed to properly define a threshold. It is also advantageous to measure the threshold on small witness samples rather than on the full aperture part.

This issue is being addressed in two ways: 1) the use of an automated damage test system to map R-on-1 thresholds and 2) the defining of a functional threshold which sets limits on the amount of damage allowed on a functioning optic.

An automated damage test bench developed by CMO has been used to map the 3 ns, 351 nm R-on-1 threshold of 441 sites on a 351 nm HR. This data is analyzed with the goal of predicting with high confidence the damage threshold of a large-aperture component.

At LLNL a functional damage threshold has been defined which limits the maximum size of a damage site as well as the maximum fractional area effected by damage. For 1.053 μm polarizers the 10 ns damage threshold is limited by a delaminate damage morphology. An empirical power law dependence of average damage size on peak fluence has been determined which can be used to predict the damage behavior of large-aperture optics exhibiting that same damage morphology.

This work was performed with the backing of many organizations: -The Megajoule Project (EME-CEA Department Limeil-Valenton) -The French Ministry of Defence (Group IV)

*Work performed under the auspices of the U. S. Department of Energy by Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.